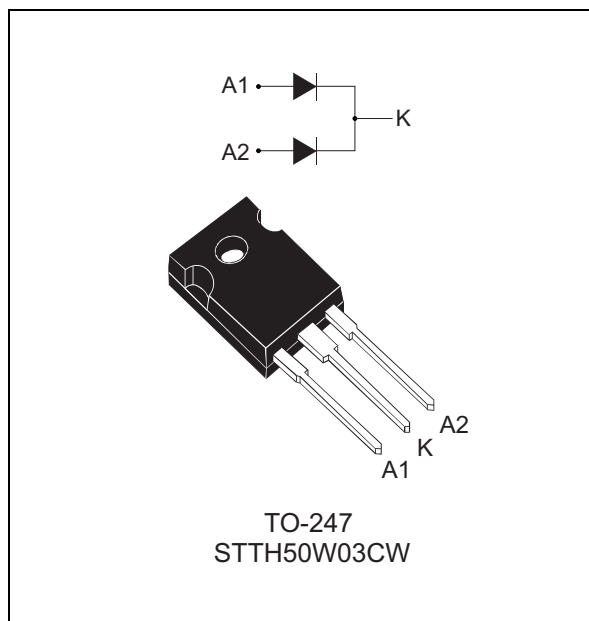


## Turbo 2 ultrafast high voltage rectifier

Datasheet — production data



### Description

The STTH50W03C uses ST Turbo 2 300 V technology. It is especially suited to be used for DC/DC and DC/AC converters in the secondary stage of MIG/MMA/TIG welding machines. Housed in ST's TO-247, this device offers high power integration for all welding machines and industrial applications.

Table 1. Device summary

| Symbol         | Value    |
|----------------|----------|
| $I_{F(AV)}$    | 2 x 25 A |
| $V_{RRM}$      | 300 V    |
| $t_{rr}$ (typ) | 20 ns    |
| $T_j$          | 175 °C   |
| $V_F$ (typ)    | 1 V      |

### Features

- Ultrafast switching
- Low reverse recovery current
- Low thermal resistance
- Reduces switching losses
- ECOPACK<sup>®</sup>2 compliant component

# 1 Characteristics

**Table 2. Absolute ratings (limiting values per diode, at 25 °C, unless otherwise specified)**

| Symbol              | Parameter                              |                                   |            | Value        | Unit |
|---------------------|----------------------------------------|-----------------------------------|------------|--------------|------|
| V <sub>RRM</sub>    | Repetitive peak reverse voltage        |                                   |            | 300          | V    |
| I <sub>F(RMS)</sub> | Forward rms current                    |                                   |            | 40           | A    |
| I <sub>F(AV)</sub>  | Average forward current, δ = 0.5       | T <sub>c</sub> = 105 °C           | Per diode  | 25           | A    |
|                     |                                        | T <sub>c</sub> = 100°C            | Per device | 50           |      |
| I <sub>FSM</sub>    | Surge non repetitive forward current   | t <sub>p</sub> = 10 ms sinusoidal |            | 200          | A    |
| T <sub>stg</sub>    | Storage temperature range              |                                   |            | -65 to + 175 | ° C  |
| T <sub>j</sub>      | Maximum operating junction temperature |                                   |            | + 175        | ° C  |

**Table 3. Thermal resistance**

| Symbol        | Parameter        |           | Value | Unit   |
|---------------|------------------|-----------|-------|--------|
| $R_{th(j-c)}$ | Junction to case | Per diode | 1.8   | °C / W |
|               |                  | Total     | 1     |        |
| $R_{th(c)}$   | Coupling         |           | 0.2   |        |

When diodes 1 and 2 are used simultaneously:

$$T_{j(\text{diode } 1)} = P_{(\text{diode } 1)} \times R_{th(j-c)}(\text{Per diode}) + P_{(\text{diode } 2)} \times R_{th(c)}$$

**Table 4. Static electrical characteristics per diode**

| Symbol      | Parameter               | Test conditions       |                     | Min. | Typ  | Max. | Unit          |
|-------------|-------------------------|-----------------------|---------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$  | $V_R = V_{RRM}$     |      |      | 15   | $\mu\text{A}$ |
|             |                         | $T_j = 125\text{ °C}$ |                     |      | 15   | 150  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25\text{ °C}$  | $I_F = 25\text{ A}$ |      |      | 1.5  | V             |
|             |                         | $T_j = 150\text{ °C}$ |                     |      | 1.0  | 1.2  |               |
|             |                         | $T_j = 25\text{ °C}$  | $I_F = 50\text{ A}$ |      |      | 1.8  |               |
|             |                         | $T_j = 150\text{ °C}$ |                     |      | 1.25 | 1.5  |               |

1. Pulse test:  $t_p = 5\text{ ms}$ ,  $\delta < 2\%$

2. Pulse test:  $t_p = 380\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses use the following equation:

$$P = 0.9 \times I_{F(AV)} + 0.012 I_{F(RMS)}^2$$

Table 5. Dynamic electrical characteristics per diode

| Symbol       | Parameter                | Test conditions                     |                                                                                       | Min. | Typ | Max. | Unit |
|--------------|--------------------------|-------------------------------------|---------------------------------------------------------------------------------------|------|-----|------|------|
| $I_{RM}$     | Reverse recovery current | $T_j = 125\text{ }^{\circ}\text{C}$ | $I_F = 25\text{ A}$ , $V_R = 200\text{ V}$<br>$di_F/dt = -200\text{ A}/\mu\text{s}$   |      | 7   | 9    | A    |
| $Q_{RR}$     | Reverse recovery charge  |                                     |                                                                                       |      | 170 |      | nC   |
| $S_{factor}$ | Softness factor          |                                     |                                                                                       |      | 0.3 |      |      |
| $t_{rr}$     | Reverse recovery time    | $T_j = 25\text{ }^{\circ}\text{C}$  | $I_F = 1\text{ A}$ , $V_R = 30\text{ V}$<br>$di_F/dt = -100\text{ A}/\mu\text{s}$     |      | 20  | 27   | ns   |
| $t_{fr}$     | Forward recovery time    | $T_j = 25\text{ }^{\circ}\text{C}$  | $I_F = 25\text{ A}$ , $V_{FR} = 1.2\text{ V}$<br>$di_F/dt = 400\text{ A}/\mu\text{s}$ |      |     | 120  | ns   |
| $V_{FP}$     | Forward recovery voltage |                                     |                                                                                       |      | 2.5 | 3.6  | V    |

Figure 1. Average forward power dissipation versus average forward current (per diode)

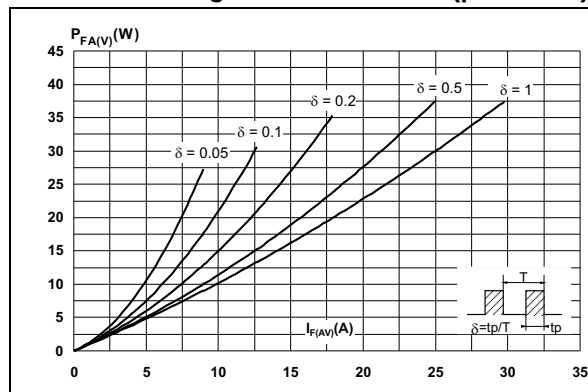


Figure 2. Forward voltage drop versus forward current (typical values, per diode)

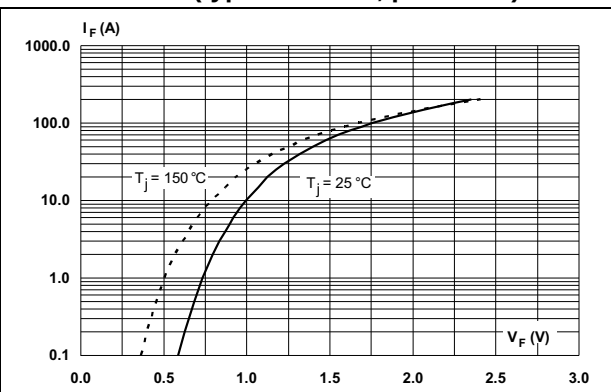


Figure 3. Forward voltage drop versus forward current (maximum values, per diode)

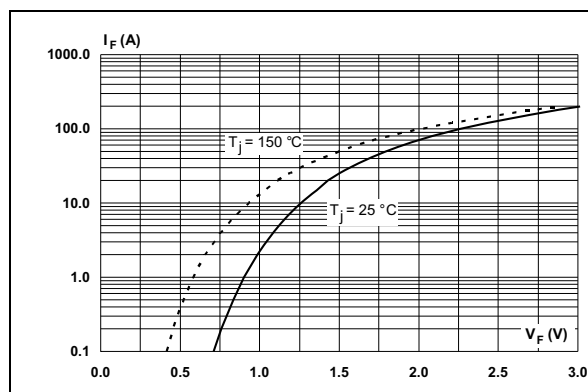


Figure 4. Relative variation of thermal impedance junction to case versus pulse duration

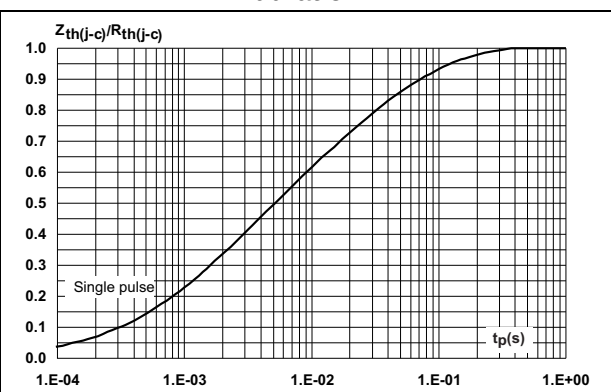


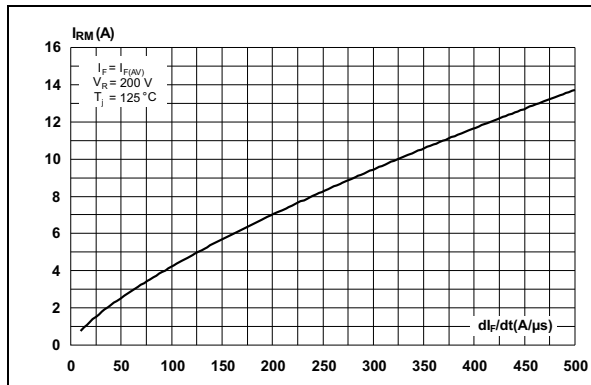
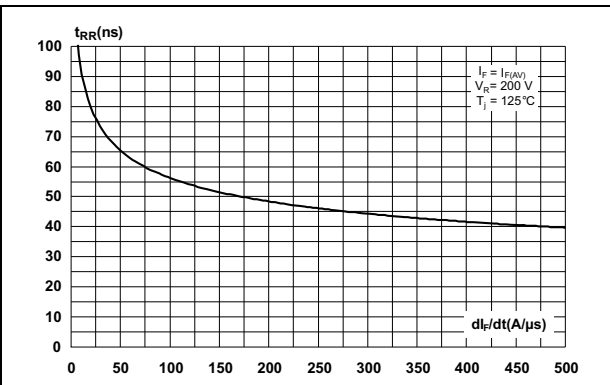
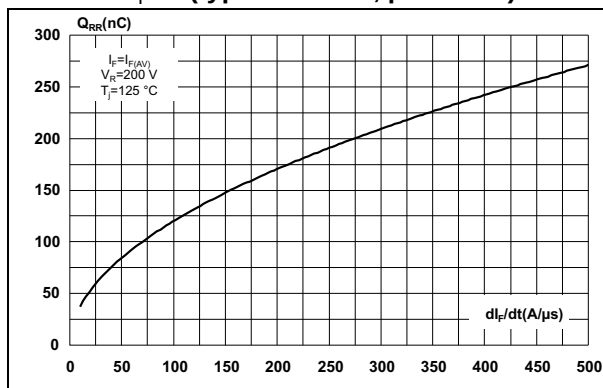
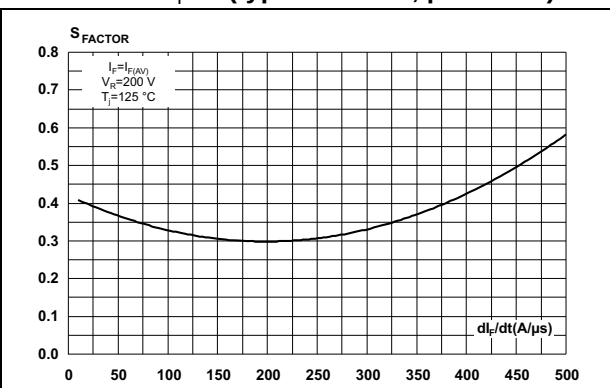
Figure 5. Peak reverse recovery current versus  $dl_F/dt$  (typical values, per diode)Figure 6. Reverse recovery time versus  $dl_F/dt$  (typical values, per diode)Figure 7. Reverse recovery charges versus  $dl_F/dt$  (typical values, per diode)Figure 8. Reverse recovery softness factor versus  $dl_F/dt$  (typical values, per diode)

Figure 9. Relative variations of dynamic parameters versus junction temperature

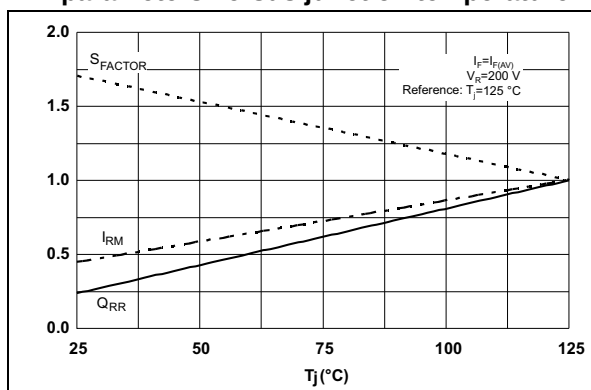
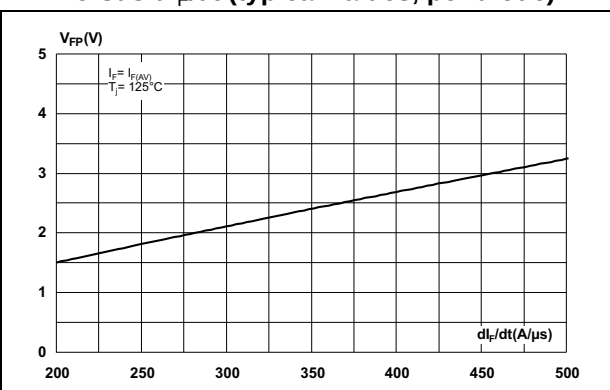
Figure 10. Transient peak forward voltage versus  $dl_F/dt$  (typical values, per diode)

Figure 11. Forward recovery time versus  $di_F/dt$  (typical values, per diode)

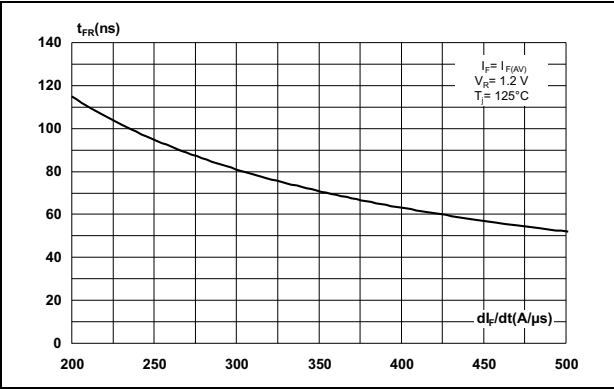
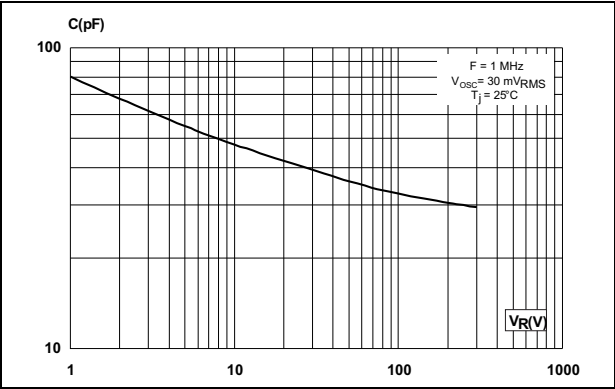


Figure 12. Junction capacitance versus reverse voltage applied (typical values, per diode)



## 2 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.5 N·m
- Maximum torque value: 1.0 N·m

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**Figure 13. TO-247 dimension definitions**

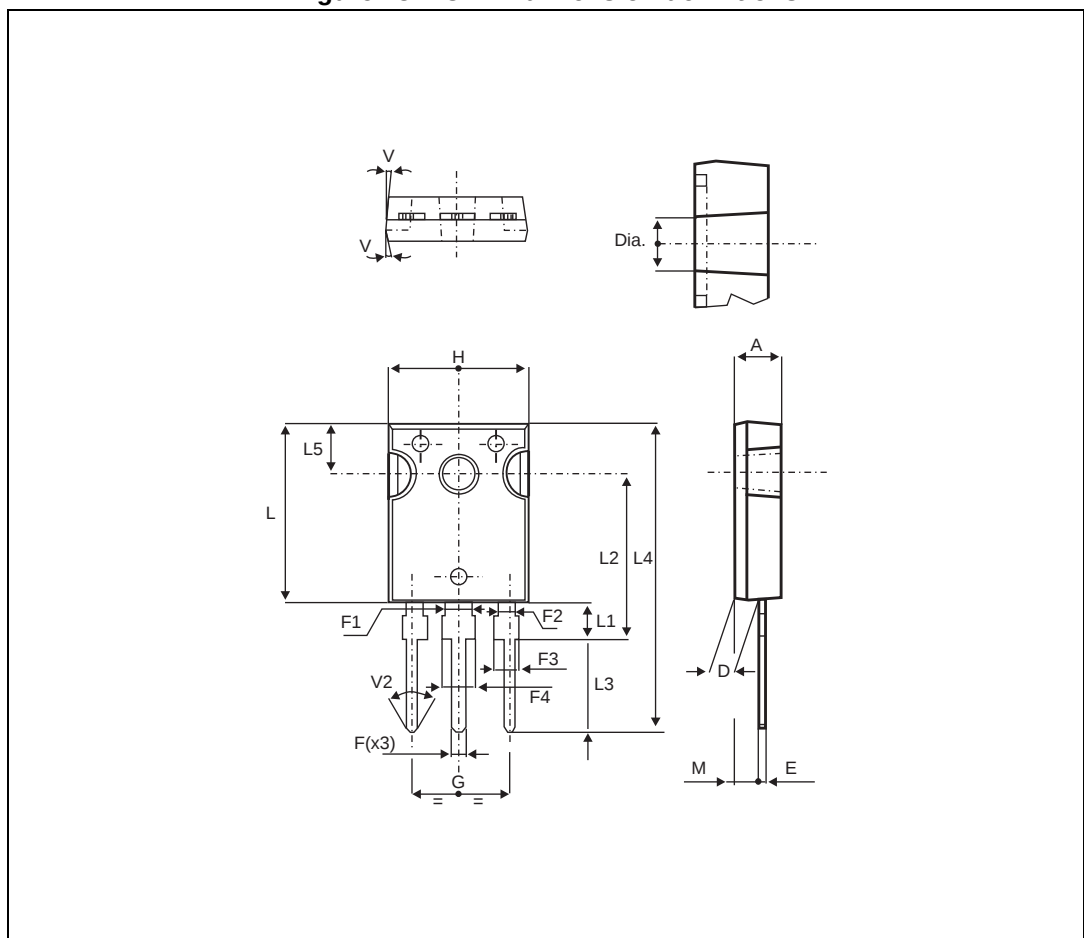


Table 6. TO-247 dimension values

| Ref.              | Dimensions  |      |       |            |       |       |
|-------------------|-------------|------|-------|------------|-------|-------|
|                   | Millimeters |      |       | Inches     |       |       |
|                   | Min.        | Typ. | Max.  | Min.       | Typ   | Max.  |
| A                 | 4.85        |      | 5.15  | 0.191      |       | 0.203 |
| A1                | 2.20        |      | 2.60  | 0.086      |       | 0.102 |
| b                 | 1.00        |      | 1.40  | 0.039      |       | 0.055 |
| b1                | 2.00        |      | 2.40  | 0.078      |       | 0.094 |
| b2                | 3.00        |      | 3.40  | 0.118      |       | 0.133 |
| c                 | 0.40        |      | 0.80  | 0.015      |       | 0.031 |
| D <sup>(1)</sup>  | 19.85       |      | 20.15 | 0.781      |       | 0.793 |
| E                 | 15.45       |      | 15.75 | 0.608      |       | 0.620 |
| e                 | 5.30        | 5.45 | 5.60  | 0.209      | 0.215 | 0.220 |
| L                 | 14.20       |      | 14.80 | 0.559      |       | 0.582 |
| L1                | 3.70        |      | 4.30  | 0.145      |       | 0.169 |
| L2                | 18.50 typ.  |      |       | 0.728 typ. |       |       |
| ØP <sup>(2)</sup> | 3.55        |      | 3.65  | 0.139      |       | 0.143 |
| ØR                | 4.50        |      | 5.50  | 0.177      |       | 0.217 |
| S                 | 5.30        | 5.50 | 5.70  | 0.209      | 0.216 | 0.224 |

1. Dimension D plus gate protrusion does not exceed 20.5 mm.
2. Resin thickness around the mounting hole is not less than 0.9 mm.

### 3 Ordering information

Table 7. Ordering information

| Ordering type | Marking     | Package | Weight | Base qty | Delivery mode |
|---------------|-------------|---------|--------|----------|---------------|
| STTH50W03CW   | STTH50W03CW | TO-247  | 4.46 g | 50       | Tube          |

### 4 Revision history

Table 8. Document revision history

| Date        | Revision | Changes      |
|-------------|----------|--------------|
| 09-Aug-2013 | 1        | First issue. |

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